belong to the Cretaceous. Of course in the absence of fruits and seeds the determinations are not altogether satisfactory. In any event, the families thought to be represented, each by one to three species, are Magnoliaceae, Anonaceae, Fagaceae, Myristicaceae, Lythraceae, Moraceae, Rubiaceae, Guttiferae, Burseraceae, Anacardiaceae, Ericaceae, Dipterocarpaceae, and Ternstroemiaceae. If one can draw any conclusion from this showing, it is that the dicotyledonous series was represented practically throughout its present extent.—J. M. C.

Morphology of Calycularia.—CAMPBELL[9] has studied the rare Javanese liverwort *Calycularia radiculosa*, found in small quantities near Tjibodas. The plant is strictly dioicous, the males being decidedly smaller than the females. It perhaps more nearly resembles *Symphyogyna* than *Pallavicinia* (*Blyttia*), with which a comparison is made. The endophytic fungus common to so many liverworts is conspicuous. Two forms of apical cells are present: one is the cylindric-lenticular type found in *Pellia epiphylla;* the other is the cuneate type common to Marchantiales, *Sphaerocarpus*, and most Anthocerotales.

Branching of *Calycularia* he says, "seems to be a true dichotomy, but whether one of the branches retains the original apical cell or whether two new apical cells are developed was not investigated." In order to have true dichotomy, the original apical cell by equal division must give rise to two new apical cells. But if, on the other hand, the original apical cell is retained by one branch, the apical cell of the other branch must be formed from a segment of the original apical cell, and we have, not *true* dichotomy, but *apparent* dichotomy. Of course in most cases, whether we have true or simulated dichotomy makes little difference in the appearance of the adult plant.

The earliest stages of the antheridium were not studied, but apparently it develops like that of the majority of Jungermanniales. In the ultimate division of the spermatogenous cells a wall is formed. No trace of a "Nebenkörper" or "accessory body" was found. Archegonia are grouped on a rudimentary receptacle. The number of neck cells is various, the highest number found being eight. Occasionally a binucleate neck canal cell was found, showing that the neck is being shortened. In one archegonium neck canal cells were enlarged and closely resembled eggs. This seeming reversion to a more primitive type of archegonium seems to be widespread in bryophytes.

Early stages in embryogeny were not studied. The capsule has a relatively thick wall. The foot is the mushroom-anchor shape so common in liverworts. The spore mother cells are deeply lobed, as is characteristic of practically all Jungermanniales. The "quadripolar" spindle of FARMER was

[9] CAMPBELL, DOUGLAS HOUGHTON, The morphology and systematic position of *Calycularia radiculosa* Steph. Leland Stanford Junior Univ. Publ., Univ. Series, Dudley Mem. Vol. pp. 43–61. *figs. 12.* 1913.

noted, but occasionally a conspicuous bipolar spindle was seen. *Calycularia* therefore seems to be a suitable form for settling the FARMER-MOORE controversy, and it is greatly to be regretted that CAMPBELL'S material is so scanty. He thinks that *Calycularia radiculosa* should be made the type of a new genus intermediate between *Mörkia* and forms like *Makinoa* or *Pellia*.—W. J. G. LAND.

Embryo sac of Aglaonema.—CAMPBELL[10] has published a further study of the embryo sac and embryo of *Aglaonema*, the species investigated being *A. simplex* and *A. modestum*. Among the results are the following: the primary sporogenous cell develops the embryo sac directly; the first divisions in the embryo sac result in four free nuclei arranged in pairs, and only one of the micropylar nuclei divides, producing the synergids, the other without division becoming the egg nucleus; there is no nuclear fusion preceding endosperm formation and there are no definite antipodal cells; no evidence of fertilization was seen; the sac becomes filled with endosperm tissue; in embryoformation the synergids remain intact, "and it sometimes looks as if they also contributed to the tissues of the embryo"; the embryo finally completely fills the sac, the body regions being differentiated at a late stage in the development. —J. M. C.

Sex in Onoclea.—Miss WUIST[11] has used *Onoclea Struthiopteris* in an investigation to determine whether the sex of the dioecious gametophytes is predetermined in the spore. Soil and solution cultures were employed, also different intensities of insolation. The work has extended through several years, so that the results are well established, the fundamental one being that the sex of the gametophyte is not predetermined in the spore. It was shown that the gametophyte is either monoecious or apparently dioecious according to its age and environment; for example, in younger cultures in soil 5 per cent of all the gametophytes were monoecious; in older cultures 15 per cent were monoecious. A striking result was that 90 per cent of the gametophytes which originally bore archegonia were induced later, by "favorable conditions of nutrition," to produce antheridia; while 5 per cent of the gametophytes which originally bore antheridia were induced later to produce archegonia. The "male tendency" appeared to be latent in all parts of the apparently female gametophyte. The effect of various cultures and the incidental responses of various kinds are very suggestive.—J. M. C.

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[10] CAMPBELL, D. H., The embryo sac of *Aglaonema*. Scottish Bot. Review 1:110–115. *pls. 1–4.* 1912.

[11] WUIST, ELIZABETH DOROTHY, Sex and development of the gametophyte of *Onoclea Struthiopteris*. Physiol. Researches 1:93–132. *figs. 15.* 1913.